CLAIMS

We claim:

1. A quantum limit catalyst comprising:

atomic aggregations, said atomic aggregations comprising an assembly of atoms of one or more elements, said atomic aggregations having a size, said size placing said atomic aggregations in the quantum limit, said quantum limit atomic aggregations having a property selected from the group consisting of atomic configuration, wavefunction overlap, bonding, and spatial distribution of electron density that differs from said property when said assembly of atoms is in the macroscopic limit, said differing property modifying a catalytic property of said assembly of atoms.

2. The catalyst of claim 1, wherein said differing property is wavefunction overlap.

3. The catalyst of claim 1, wherein said differing property is spatial distribution of electron density.

4. The catalyst of claim 1, wherein said atomic aggregations comprise a transition metal.

5. The catalyst of claim 1, wherein said atomic aggregations comprise Fe, Mg, V, or Co.

6. The catalyst of claim 1, wherein said size of said atomic aggregations is less than or equal to 40 Å.

7. The catalyst of claim 1, wherein said size of said atomic aggregations is less than or equal to 20 Å.

8. The catalyst of claim 1, wherein said catalyst is a hydrogen storage material.

9. The catalyst of claim 8, wherein said catalytic property is hydrogen storage capacity.

10. The catalyst of claim 8, wherein said catalytic property is rate of hydrogen absorption.

11. The catalyst of claim 8, wherein said hydrogen storage material comprises Mg.

12. The catalyst of claim 11, wherein said catalyst absorbs hydrogen in its unactivated state.

13. The catalyst of claim 12, wherein said unactivated hydrogen storage material absorbs at least 4.5 wt.% hydrogen.

14. The catalyst of claim 12, wherein said unactivated hydrogen storage material absorbs at least 3.5 wt.% hydrogen.

15. The catalyst of claim 12, wherein said unactivated hydrogen storage material absorbs hydrogen at a temperature of 30 °C or above.

16. The catalyst of claim 15, wherein said unactivated hydrogen storage material absorbs at least 0.19 weight percent hydrogen.

17. The catalyst of claim 12, wherein said unactivated hydrogen storage material absorbs hydrogen at a temperature of 50 °C or above.

18. The catalyst of claim 17, wherein said unactivated hydrogen storage material absorbs at least 0.43 weight percent hydrogen.